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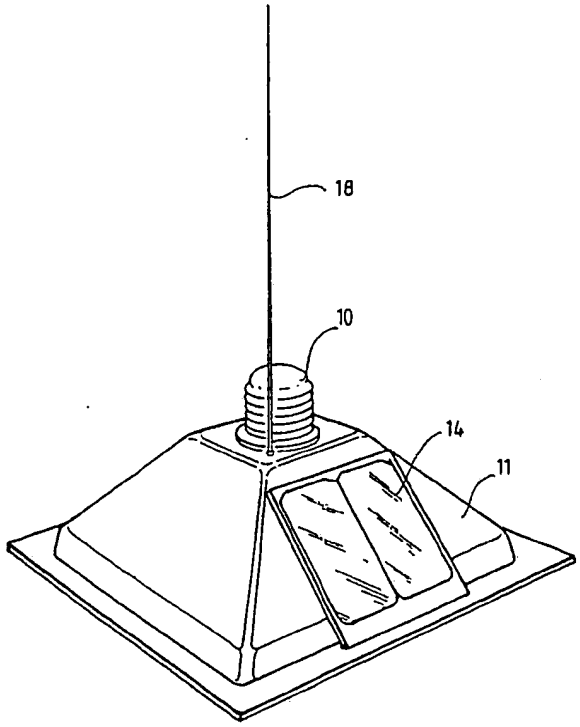
(54) Title: PILOT ACTIVATED RUNWAY LIGHTING SYSTEM

(57) Abstract

A pilot activated, self-contained runway lighting system to assist in the landing of aircraft, including a lamp (10), battery means for operating the lamp (10) charged by a solar energy battery circuit, and switch means for activating the lamp in response to coded signals generated by a radio transmitter.



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PILOT ACTIVATED RUNWAY LIGHTING SYSTEM

The present invention relates to a pilot activated lighting system.

BACKGROUND OF THE INVENTION

Full runway lighting for smaller airports and private landing strips are expensive to install and maintain. With a withdrawal of Government funding for airport lighting there is a need to provide an affordable system that is easily installed and virtually maintenance free. Such a system must also be able to operate without requiring airport personnel.

OBJECTS OF THE INVENTION

It is an object of the present invention to provide solutions to the abovementioned problems.

SUMMARY OF THE INVENTION

With this object in view the present invention in a preferred aspect may provide a self-contained lighting system including a lamp, a battery means for operating said lamp, a solar energy battery charging circuit and switch means for activating said lamp, said switch means being responsive to a code or codes transmitted by a radio transmitter.

In a preferred embodiment said switch means is responsive to a first code for activating said lamp and a second code for de-activating said lamp. Preferably activation of said lamp is for a predetermined time after which said lamp is de-activated. If required said lamp can flash to indicate that said predetermined time is near completion.

DESCRIPTION OF PREFERRED EMBODIMENT

In order that the invention may be clearly understood and readily put into practical effect, a preferred non-limitative embodiment of a pilot activated lighting system will now be

described with reference to the accompanying drawings, in which:-

Fig. 1 is a perspective view of a pilot activated lighting system made in accordance with the invention;

Fig. 2 is a block circuit diagram shown the pilot activated lighting system made in accordance with the invention;

Fig. 3 is a circuit diagram of the RF receiving section of the system shown in Fig. 2;

Fig. 4 is a circuit diagram of the counter section of the system shown in Fig. 2;

Fig. 5 is a circuit diagram of the flasher section of the system shown in Fig. 2; and

Fig. 6 is the crystal oscillator section for the RF receiving section shown in Fig. 3.

In Figs. 1 and 2 there is shown a pilot activated lighting system made in accordance with the invention. The system is self-contained and is not dependent on further modules for its operation. Each system contains a lamp 10, a battery or batteries 12, solar panels 14 and a charge control circuit 16. The system is incorporated in a housing 11 which is placed beside the runway in an appropriate position. Housing 11 encloses battery 12 and charge control circuit 16. Housing 11 is preferably made from a UV stabilised, vacuum formed plastics material which is very durable. If desired housing 11 can be designed to collapse if struck by an aircraft. Lamp 10 is typically a 10 watt quartz halogen globe which has a light output equivalent to a 30 watt tungsten globe. A plurality of such systems will provide sufficient lighting to enable a pilot to land a plane. If required one system can be used to light a windsock or any other device.

To control lamp 10 circuitry is provided to activate lamp 10. The circuitry includes an antenna 18 which is coupled to a VHF receiver detector 20. Detector 20 receives VHF signals from the

pilot's VHF transmitter (not shown). Each transmission sensed by detector 20 is transformed to a pulse which is coupled to a four pulse counter 22 and a first timer 24. Timer 24 resets counter 22 15 seconds after first being activated. A latch 26 is coupled to counter 22 and will be turned on after receiving three pulses from counter 22. Latch 26 will turn on lamp 10 through switch/relay 28 and a second timer 30. Second timer 30 will turn off the lamp after a thirty minute countdown. A third timer 32 is provided which controls a flasher unit 34 to cause blinking of lamp 10. The third timer will turn on after 20 minutes to indicate that only 10 minutes remains for the lighting to remain activated. The times for each timer and the numbers of pulses received by counter 22 can be varied depending on particular requirements. A light-sensitive switch 36 can also be provided to ensure the lighting system is not turned on during daylight hours which could drain battery 12.

Figs. 3 to 6 show circuit diagrams which enable the block diagram of Fig. 2 to be realised. The circuit components shown in Figs. 3 to 6 have been referenced to Fig. 2 where applicable. In this preferred embodiment the discrete components can be substituted by other circuitry and, if required, could be substantially replaced by microprocessor circuitry. Antenna 18 feeds into IC7 which is a FM narrowband receiver circuit. The audio frequency output from IC7 is filtered by an operational amplifier IC8 to provide a trigger pulse TRIG, using relay REL1 for each pilot transmission at the selected frequency on his VHF transmitter. The pilot depresses his call button three times within 15 seconds to supply the code for activating lamp 10. The trigger pulse TRIG is fed to IC1, a quad type D flip-flip.

The four flip-flops in IC1 are used to form the four pulse counter 22. When the first trigger-pulse TRIG is received by IC1 a fifteen (15) second timer IC2 is initialised. After fifteen seconds timer

IC2 resets counter IC1 to allow the sequence to start again. If three trigger pulses TRIG are received in the fifteen second duration of timer IC2 then an output is fed from pin 10 of IC1 to latch IC3. Any resetting of counter IC1 will not affect latch IC3. Latch IC3 turns on transistor Q3 to activate a relay REL2 which controls lamp 10. The output from pin 10 of IC1 is also fed to timer IC4 and to timer IC5. Timer IC4 provides a thirty minute countdown whilst IC5 provides a twenty minute countdown.

At the completion of the twenty minute countdown IC5 sends an output to transistor Q4 to turn on timer IC6. Timer IC6 provides a pulsed output to turn on and off the relay REL2 controlling lamp 10. Lamp 10 will flash continuously as a warning that the thirty minute time limit is shortly to expire and to reduce the load on battery 12.

At the completion of the thirty minute countdown the output (pin 8) of IC4 will reset latch IC3. Transistor Q3 will turn off which releases the relay REL2 and extinguishes lamp 10.

If the pilot depresses his call button a further three times whilst the thirty minute countdown is occurring then latch IC3 and timers IC4, IC5 will be reset providing a fresh thirty minute countdown. If four pulses are received by counter IC1 then the output from pin 15 will reset latch IC3 and extinguish lamp 10. Thus, three depressions of the call button in fifteen seconds will turn on the lamp for thirty minutes whilst four depressions will turn off the lamp immediately rather than wait for the thirty minute timeout. The ability to turn off lamp 10 results in a more flexible system and does not drain battery 12 to the same extent as the thirty minute timeout. If required a switch (not shown) can be placed between contacts SW1, SW2 (Fig. 4) to provide a manual override of the system.

The integrated circuit packages are as follows:-

IC1	14175
IC2	14541
IC3	14013
IC4	14541
IC5	14541
IC6	NE555
IC7	MC3362 (Motorola) - TDA7000 (Philips) can also be used.
IC8	LM386

In practice battery or batteries 12 are typically two 6V 10 amp/hour batteries in parallel which draws 1.6 amps per hour. The VHF receiver detector 20 draws less than 15mA allowing for 12 hours of illumination. In the preferred embodiment, the detector 20 draws as little as 8mA.

The advantages of the invention are readily identified. As each system is self-contained they are readily moved if a change of runway is required. Each system is activated independently and by the same VHF signals. If any system fails, or fails to operate, the remaining systems will not be affected. The system requires very little maintenance. Discharge of batteries 12 is replaced via a 450 m.a. solar voltaic array averaging 3 a/h replenishment on any given day. This enables the system to be active as a runway light for up to 2 hours, (4 x 30 minute cycles) on any given night. Recharging to full capacity will then be achieved during the following daylight. Due to the insignificant amount of power drawn by the receiver 20

and the inclusion of a light dependent switch 36 rendering it inactive during daylight hours, battery storage is not significantly affected.

It is believed that the invention and may of its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction and arrangement of the parts and that changes may be made in the form, constructions and arrangement of the pilot activated lighting system described without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the forms hereinbefore described being merely preferred embodiments thereof.

CLAIMS

1. A self-contained lighting system including a lamp, a battery means for operating said lamp, a solar energy battery charging circuit and switch means for activating said lamp, said switch means being responsive to a code or codes transmitted by a radio transmitter.

2. The lighting system of claim 1, wherein said switch means is responsive to a first code for activating said lamp and a second code for de-activating said lamp.

3. The lighting system, of claim 2, wherein activation of said lamp is for a predetermined time after which said lamp is de-activated.

4. The lighting system of claim 3, wherein said lamp flashes to indicate when said pre-determined time is near completion.

5. The lighting system of claim 1, wherein said switch means includes a VHF receiver detector, each code or codes from said radio transmitter received by said VHF receiver detector being converted to a pulse.

6. The lighting system of claim 5, wherein each pulse is coupled to a counter, said counter being coupled to a latch which activates said lamp after a predetermined number of pulses have been detected.

7. The lighting system of claim 6, wherein said latch is coupled to a timer, said timer resetting said latch after a predetermined time has elapsed.

8. The lighting system of any one of claims 5 to 7, further including a further timer coupled to said counter, said further time resetting said counter after a predetermined time has elapsed.

9. The lighting system of any one of claims 6 to 8, further including an additional timer coupled to said counter, said additional timer activating a flasher means to cause said lamp to turn on and off sequentially.

10. The lighting system of any one of the preceding claims, further including a manual override switch to bypass said switch means to allow direct connection of said lamp to said battery means.

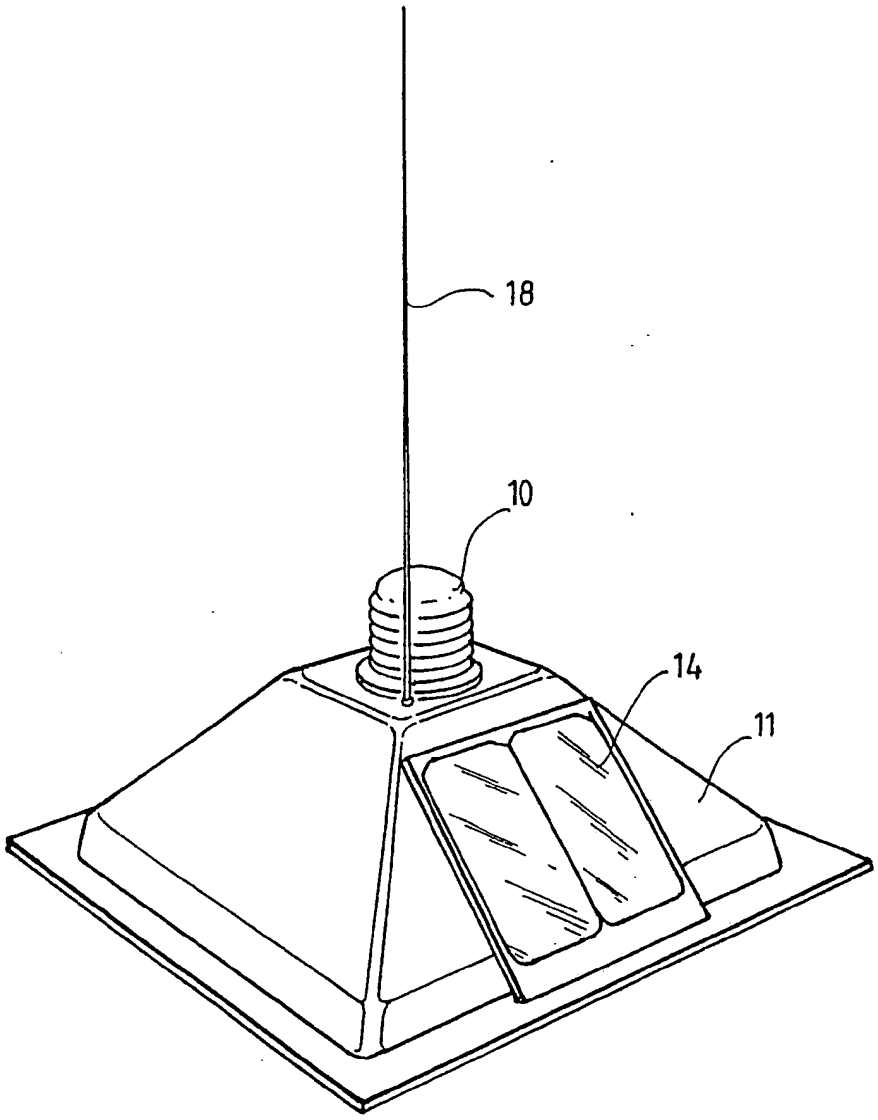


FIG. 1.

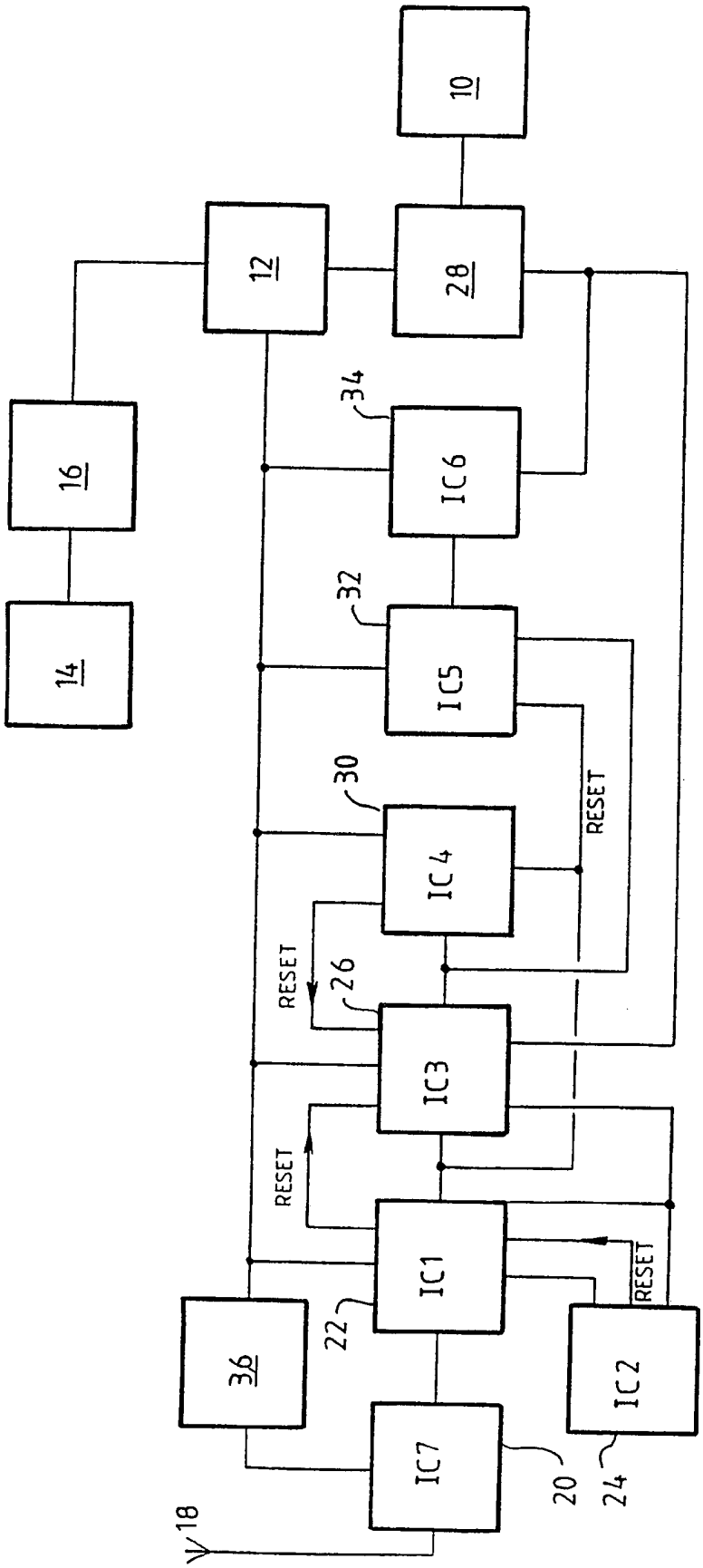

10
12
28
16
14
34
IC6
32
IC5
30
IC4
RESET
RESET
26
IC3
RESET
IC1
RESET
36
22
IC2
IC7
20
24
18

Fig. 2.

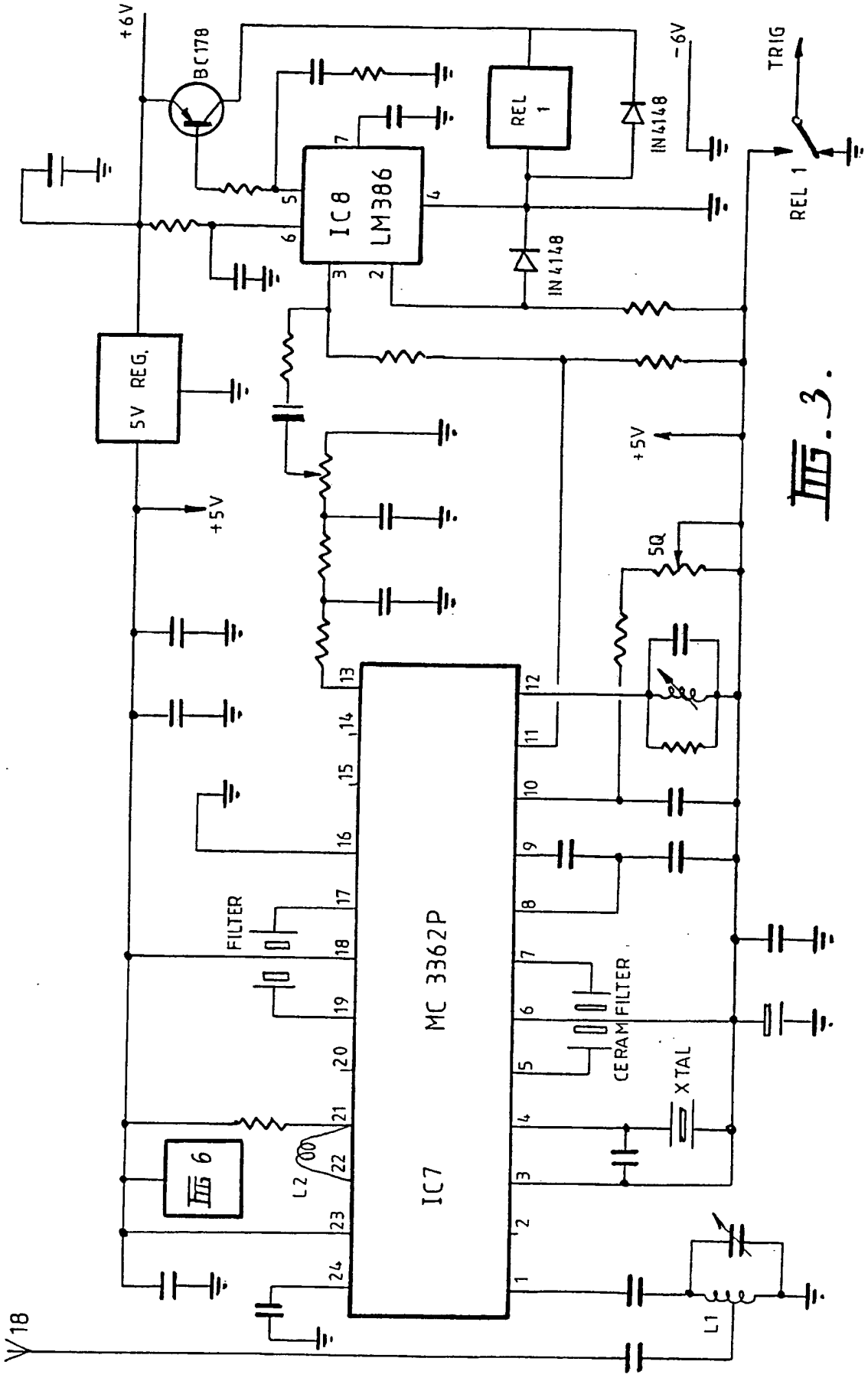


Fig. 3.

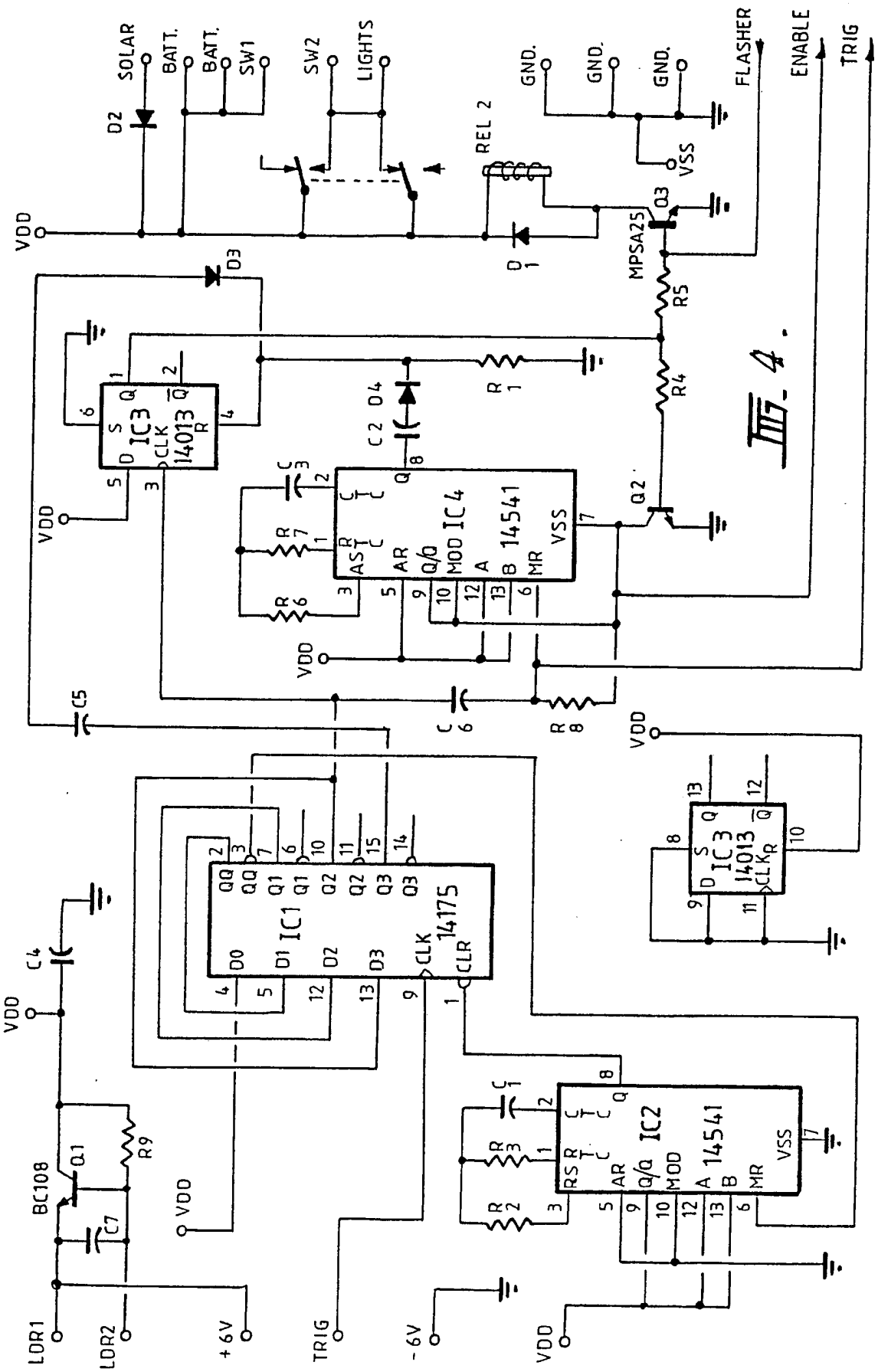
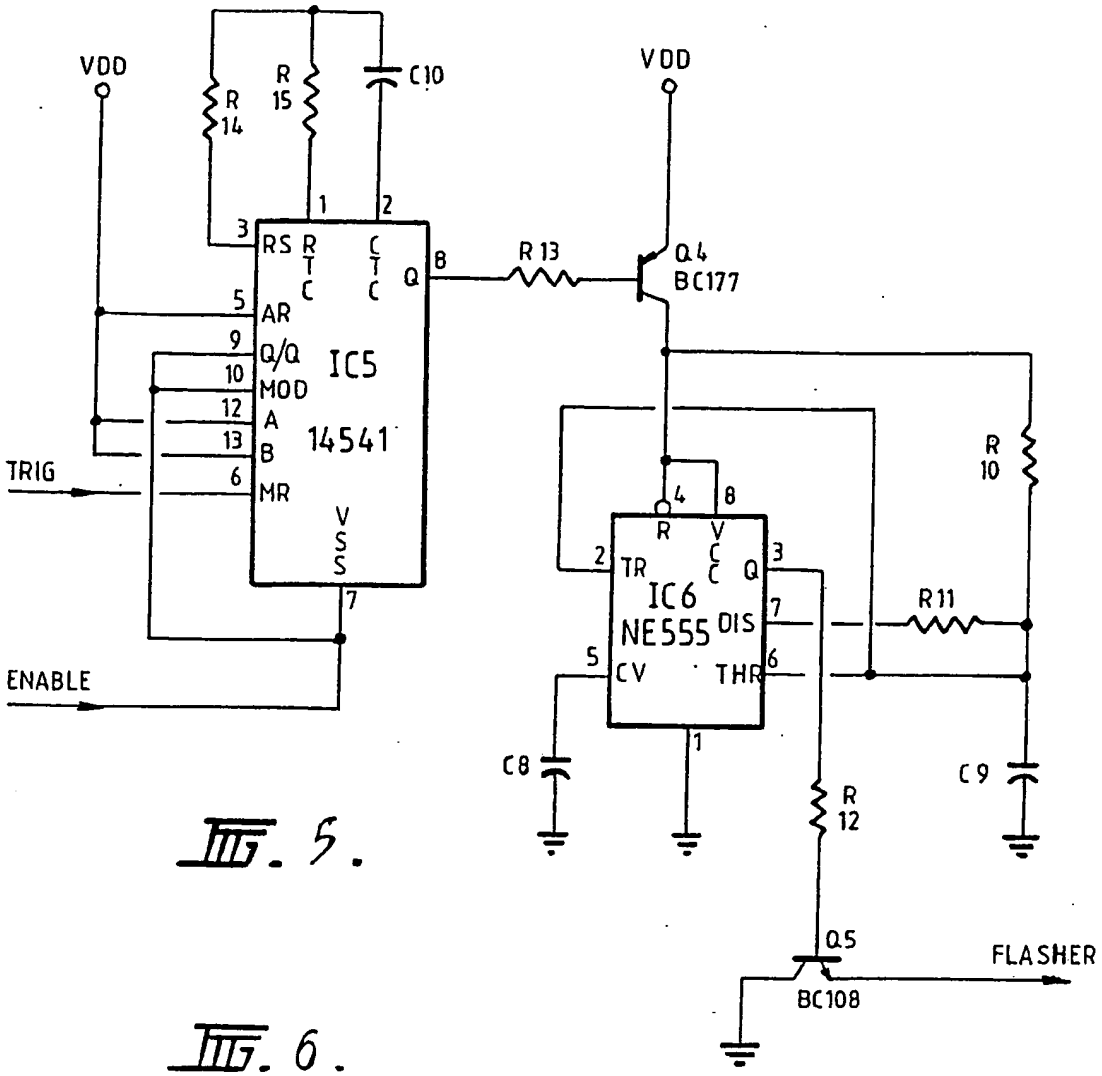


FIG. 4.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R 14
R 15
C10
VDD
RS
RTC
CTC
Q
R 13
Q4 BC177
AR
Q/Q
MOD
A
B
MR
IC5
14541
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VSS
R 10
R
VCC
TR
IC6 NE555
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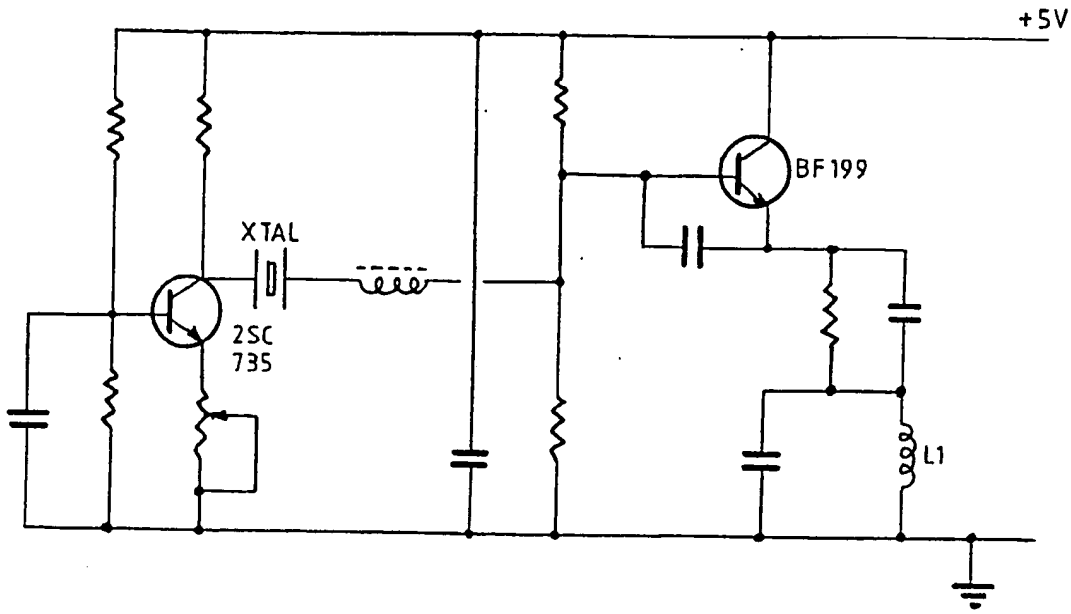
R11
CV
THR
C8
C9
R 12
Q5
BC108
FLASHER

FIG. 5.

FIG. 6.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INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU93/00006

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl.[5] B64F 1/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC B64F 1/18, F21S 9/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC as above

Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)
DERWENT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
P,X	WO,A, 92/05612 (ITALSOLAR SPA) 2 April 1992 (02.04.92) page 3 lines 4 to 25, page 5 lines 5-8	1-3, 5, 10
X	WO,A, 88/10529 (SCHNUER) 29 December 1988 (29.12.88) page 2 line 37 to page 3 line 24	1-3, 10
X	US,A, 4201973 (JACKSON et al) 6 May 1980 (06.05.80) column 1 lines 29-42, columns 3 and 4	1-2, 10

[X] Further documents are listed in the continuation of Box C.

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Date of the actual completion of the international search	Date of mailing of the international search report
8 April 1993 (08.04.93)	16 APR 1993 (16.4.93)
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	**Citation of document, with indication, where appropriate of the relevant passages**	**Relevant to Claim No.**
A	EP,A, 345141 (BRIATTE) 6 December 1989 (06.12.89) column 2 lines 7-9	1
A	FR,A, 2315096 (TONTIC) 18 February 1977 (18.02.77) page 8 lines 6-21	1
A	US,A, 3247486 (CHOISSER et al) 19 April 1966 (19.04.66) the whole document	1-10
A	US,A, 3121857 (LEMM et al) 18 February 1964 (18.02.64) the whole document	1-3, 5-8, 10
A	US,A, 3117299 (LEMM et al) 7 January 1964 (07.01.64) the whole document	1-10

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
WO	9205612	AU	86120/91				
WO	8810529	AT	1517/87	AU	18048/88	EP	328565
EP	345141	FR	2631921	US	5119090		